SUPPLEMENTARY INFORMATION FOR PLATES 2-20: Modified Mercalli Intensity Scale Summary Descriptions and "Official" Full Description

MMI Value	Description of Shaking Severity Used on Current Maps	Summary Damage Description Used on 1995 Maps	"Official" Full Description (from Richter, C.F., 1958. Elementary Seismology. W.H. Freeman and Company, San Francisco, pp. 135-149; 650-653.)
I.			Not felt. Marginal and long period effects of large earthquakes.
II.			Felt by persons at rest, on upper floors, or favorably placed.
III.			Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.
IV.			Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing motor cars rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV wooden walls and frame creak.
V.	Light	Pictures Move	Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.
VI.	Moderate	Objects Fall	Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church, school). Trees, bushes shaken (visibly, or heard to rustle).
VII.	Strong	Nonstructural Damage	Difficult to stand. Noticed by drivers of motor cars. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices (also unbraced parapets and architectural ornaments). Some cracks in masonry C. Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.
VIII.	Very Strong	Moderate Damage	Steering of motor cars affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.
IX.	Violent	Heavy Damage	General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. (General damage to foundations.) Frame structures, if not bolted, shifted off foundations. Frames racked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluvial areas sand and mud ejected, earthquake fountains, sand craters.
X.	Very Violent	Extreme Damage	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.
XI.			Rails bent greatly. Underground pipelines completely out of service.
XII.			Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.

Masonry A: Good workmanship, mortar, and design; reinforced, especially laterally, and bound together by using steel, concrete, etc.; designed to resist lateral forces.
Masonry B: Good workmanship and mortar; reinforced, but not designed in detail to resist lateral forces.
Masonry C: Ordinary workmanship and mortar; no extreme weaknesses like failing to tie in at corners, but neither reinforced nor designed against horizontal forces.
Masonry D: Weak materials, such as adobe; poor mortar; low standards of workmanship; weak horizontally.

SUPPLEMENTARY INFORMATION FOR PLATE 22: Liquefaction Susceptibility Map

MMI Value	"Official" Full Description (from Knudsen and others, 2000. Knudsen, K.L., Sowers, J.M., Witter, R.C., Wentworth, C.M., and Helley, E.J., 2000. ***Preliminary Maps of Quaternary Deposits and Liquefaction Susceptibility, Nine-County San Francisco Bay Region, California***: U. S. Geological Survey Open-File Report 00-444. Digital Database by Wentworth, C.M., Nicholson, R.S., Wright, H.M., and Brown, K.H. Online Version 1.0.)
Very High	Very High
High	High
Moderate	Moderate
Low	Low
Very Low	Very Low

The following additional information on liquefaction affects is from Perkins, 2001.[1]

Liquefaction damage, Marina District, 1989 Loma Prieta, California, Earthquake
Source – M. Bennett, U.S. Geological Survey

When the ground ***liquefies***, sandy materials saturated with water can behave like a liquid, instead of like solid ground. The ground may sink or even pull apart. Sand boils, or sand "volcanoes," can appear.

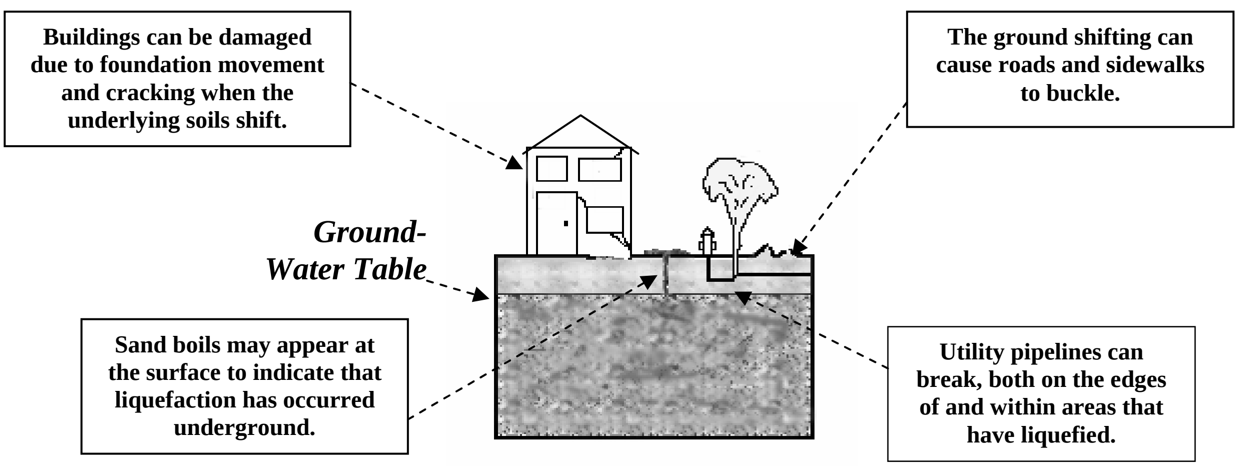
Liquefaction can cause ground displacement and ground failure such as lateral spreads (essentially landslides on nearly flat ground next to rivers, harbors, and drainage channels) and flows.

Our most vulnerable land falls into two general categories:

1. areas covered by the huge amount of fill poured into San Francisco Bay since 1845 to transform 77 square miles (200 square km) of tidal and submerged areas into land; and
2. areas along existing and filled stream channels and flood plains, particularly those areas with deposits less than 10,000 years old.

Overall, ***shaking does more damage*** to buildings and highway structures than liquefaction. ***But liquefaction damage can be a significant threat for underground pipelines, airports (especially runways), harbor facilities, and road or highway surfaces.***

FIGURE - POTENTIAL EFFECTS OF LIQUEFACTION



[1] Perkins, J.P., 2001. ***The REAL Dirt on Liquefaction***. ABAG: Oakland, CA. 25 pp.

SUPPLEMENTARY INFORMATION FOR PLATES 24-41: Liquefaction Hazard Maps (for Earthquake Scenarios)

The liquefaction hazard maps were created using a combination of liquefaction susceptibility maps and ground shaking scenario maps. The following table shows how the maps were generated.

LIQUEFACTION HAZARD BASED ON COMBINATIONS OF MODIFIED MERCALLI INTENSITY AND LIQUEFACTION SUSCEPTIBILITY

MMI Value	Description of Shaking Severity	Summary Damage Description Used on Perkins and Boatwright, 1995 Shaking Maps	Liquefaction Susceptibility Category				
			Very Low	Low	Moderate	High	Very High
V	Light	Pictures Move					
VI	Moderate	Objects Fall					
VII	Strong	Nonstructural Damage			Moderately Low	Moderately Low	Moderate
VIII	Very Strong	Moderate Damage			Moderate	Moderate	Moderate
IX	Violent	Heavy Damage			**High**	**High**	**High**
X	Very Violent	Extreme Damage			**High**	**High**	**High**

These qualitative descriptions of high, moderate, and moderately low are based, in part, on pipeline leak information from the Loma Prieta earthquake, as shown in the following table.

PIPELINE LEAKS PER KILOMETER OF PIPELINE EXPOSED TO VARIOUS COMBINATIONS OF MODIFIED MERCALLI INTENSITY AND LIQUEFACTION SUSCEPTIBILITY IN THE LOMA PRIETA EARTHQUAKE

MMI Value	Description of Shaking Severity	Summary Damage Description Used on Perkins and Boatwright, 1995 Shaking Maps	Liquefaction Susceptibility Category				
			Very Low	Low	Moderate	High	Very High
V	Light	Pictures Move	0.001	0.002	0.002	0.000	0.004
VI	Moderate	Objects Fall	0.011	0.007	0.010	0.002	0.005
VII	Strong	Nonstructural Damage	0.032	0.011	0.036	0.008	0.086
VIII	Very Strong	Moderate Damage	0.028	0.063	0.182	0.019	0.278
IX	Violent	Heavy Damage	**No Data**	**No Data**	**No Data**	**No Data**	**No Data**
X	Very Violent	Extreme Damage	**No Data**	**No Data**	**No Data**	**No Data**	**No Data**

SUPPLEMENTARY INFORMATION FOR PLATE 46: Summary Distribution of Slides and Earth Flows in the San Francisco Bay Region

Susceptibility Value on Map	"Official" Full Description (from USGS Open File Report 97-745E, 1997)
Mostly Landslides	**Mostly Landslides** - consists of mapped landslides, intervening areas typically narrower than 1500 feet, and narrow borders around landslides; defined by drawing envelopes around groups of mapped landslides.
Many Landslides	**Many Landslides** - consists of mapped landslides and more extensive intervening areas than in 'Mostly Landslide'; defined by excluding areas free of mapped landslides; outer boundaries are quadrangle and county limits to the areas in which this unit was defined.
Flatland	**Flat Land** - areas of gentle slope at low elevation that have little or no potential for the formation of slumps, translational slides, or earth flow except along stream banks and terrace margins; defined by the distribution of surficial deposits.
Few Landslides	**Few Landslides** - contains few, if any, large mapped landslides, but locally contains scattered small landslides and questionably identified larger landslides; defined in most of the region by excluding groups of mapped landslides but defined directly in areas containing the 'Many Landslides' unit by drawing envelopes around areas free of mapped landslides.
Very Few Landslides	**Very Few Landslides** – (no additional information provided)

SUPPLEMENTARY INFORMATION FOR PLATES 47 and 48: Wildland-Urban-Interface (WUI) Fire Threatened Communities and Fire Threat in the San Francisco Bay Region Map

Using a combination of the map of past wildfires (***Plate 49***) in combination with the fire threat maps (***Plates 47 and 48***), a table of the probability of an area burning in the next 50 years can be calculated. The results are shown in the following table and in Table 7 of Appendix C.

Susceptibility Value on Map	Acres Burned in Past 50 Years	Total Number of Acres Within Threat Classification	Percent of Acres That Burned in Past 50-Year Period
ON WUI MAP			
WUI Community at Risk	34,652	810,757	4.27%
ON FIRE THREAT MAP			
Extreme Fire Threat	23,012	84,661	27.18%
Very High Fire Threat	312,034	1,366,544	22.83%
High Fire Threat	159,681	1,152,490	13.86%
Moderate Fire Threat	23,333	1,168,996	2.00%
Little or No Threat	16,109	600,703	2.68%

SUPPLEMENTARY INFORMATION FOR PLATE 51: Fire-Related Risks to Ecosystem Health as Measured by Condition Class

	Low Condition Class 1	Moderate Condition Class 2	High Condition Class 3
Departure From Natural Regimes	None, minimal	Moderate	High
Vegetation Composition, Structure, Fuels	Similar	Moderately altered	Significantly different
Fire Behavior, Severity, Pattern	Similar	Uncharacteristic	Highly uncharacteristic
Disturbance Agents, Native Species, Hydrologic Functions	Within natural range of variation	Outside historical range of variation	Substantially outside historical range of variation
Increased Smoke Production	Low	Moderate	High

SUPPLEMENTARY INFORMATION FOR PLATE 52: Post-Wildfire Soil Erosion Potential

The State of California Multi-Hazard Mitigation Plan references this map. This State Plan provides the following as explanatory material.

> The effects of fire on soil resources are dependent on the intensity of the fire and are induced by soil heating and by removal of the protective cover of vegetation, litter, and duff. The magnitude of soil heating depends on fuel loading, fuel moisture content, fuel distribution, rate of combustion, soil texture, soil moisture content, and other factors. The movement of heat into the soil depends upon the peak temperature of the fire and how long the heat is present. Because fuels are not evenly distributed around a site, a single fire will cause varying levels of soil heating. The highest soil temperatures occur where fuel consumption is greatest and where the duration of burning is longest. Fires in forested areas often cause high soil temperatures due to heavy fuel accumulation. In contrast, rangelands fires are often shorter in duration and cause less soil heating because of their comparatively light fuel load.
>
> FRAP [Fire and Resource Assessment of the California Department of Forestry] used a modified form of the universal soil loss equation to predict potential soil loss from fire across California. The model characterizes the influence of vegetation and other environmental factors on soil erosion using inputs such as soil and precipitation data, topography, and vegetation cover. The main determining factor in predicting potential soil loss is changes to vegetation cover resulting from fire. These changes approximate the increase in surface erosion from future wildfire burning under both current fuel conditions and severe fire weather.